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GB A 2068431
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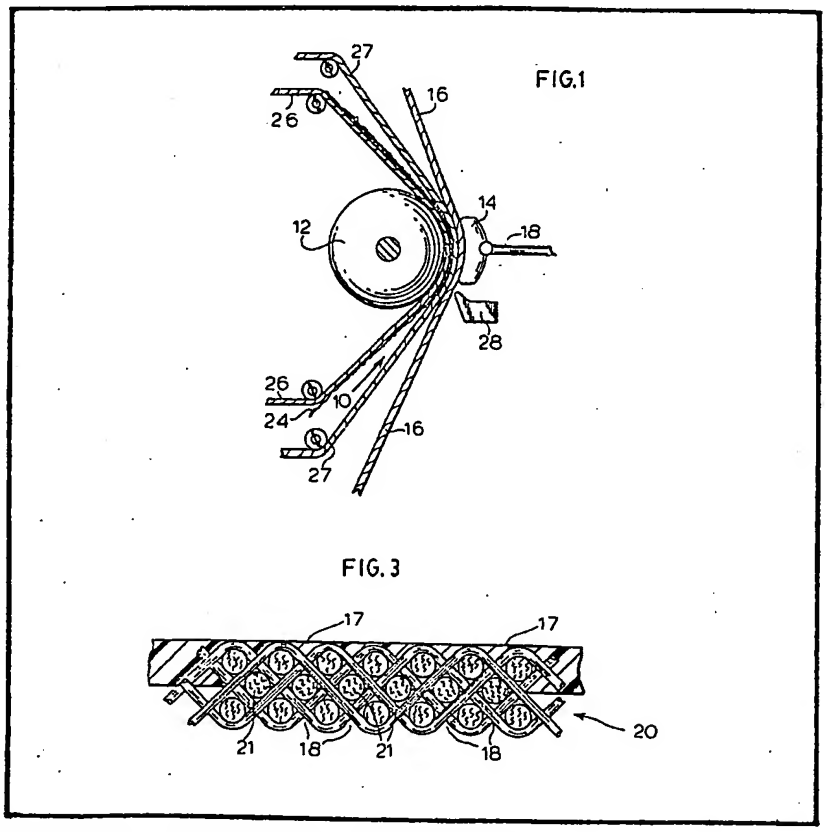
(54) Dewatering press and belt therefor

(57) A press for dewatering a fibrous web 24 includes an extended nip 10 provided between a roll 12 and an endless belt 16 which is forced towards the roll by a pressure shoe 14 positioned adjacent thereto for applying pressure to the fibrous web in the nip through the medium of the belt. The belt has a base fabric 20 partially impregnated with polymeric material 22 to provide a first impregnated side 17 which presents a uniform smooth impervious surface for engagement by the pressure shoe 14 and a second side containing voids into which liquid can be transferred from the felt 27 engaged thereby during the passage of the web 24, felts 26, 27 and belt 16 through the nip 10.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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FIG.1

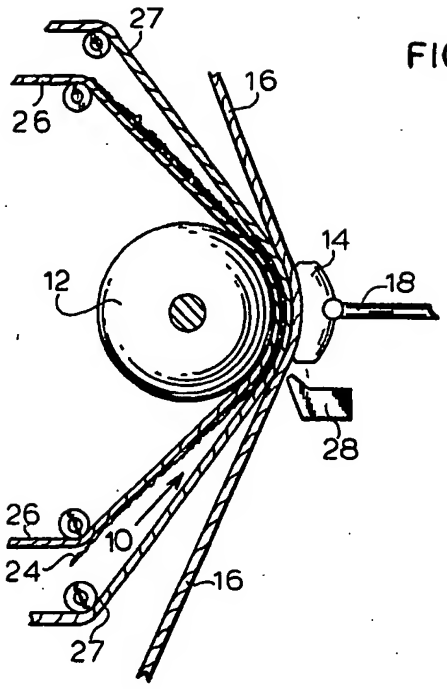

FIG.2

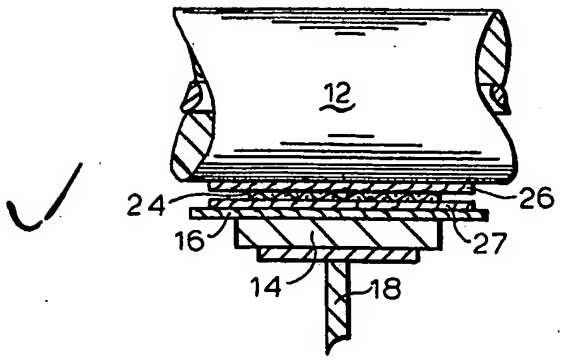

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FIG. 3

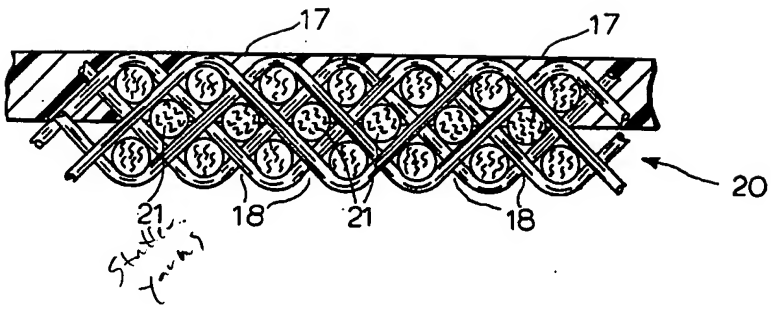
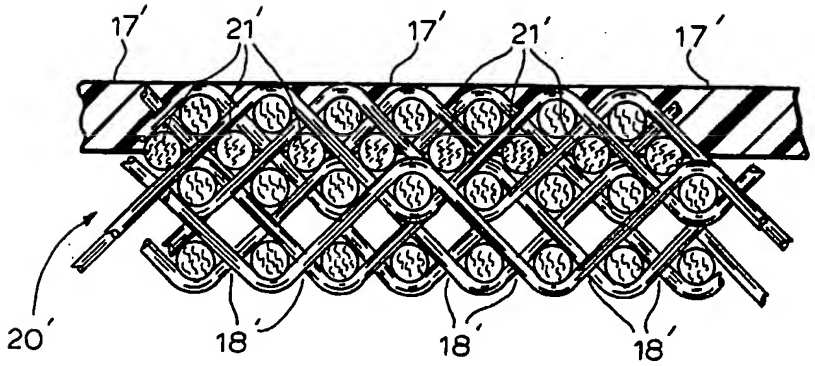


FIG. 4



SPECIFICATION

Dewatering press and belt therefor

This invention relates to presses for extracting water from webs of fibrous material, for example fibrous webs formed in papermaking machines.

During a papermaking process, a web is formed by depositing a fibrous slurry on a forming wire. A large amount of water is drained from the slurry during this process, after which the newly-formed web proceeds to a press section. The press section includes a series of press nips. The web finally proceeds to a drying section including heated dryer drums where the water content of the web is reduced to a final desired level.

In view of the high cost of energy, it is desirable to remove as much water as possible from the web prior to its entering the drying section. The dryer drums in this section are often heated by steam and costs can be substantial if a large amount of water needs to be removed.

The use of extended press nips; that is nips which extend for a substantial distance in the direction in which the web passes through them, has been found to be advantageous over the use of nips formed between pairs of adjacent rollers. By extending the time the web is subjected to pressure in the nip, a greater amount of water can be removed. This fact has been recognised by those skilled in the art, the several patents have been granted for presses with such nips. These patents include U.S. Patents Nos. 4,201,624, 4,229,253, 4,229,254 and Re30,268.

In using extended press nips to dewater a fibrous web, the web has typically been sandwiched between two moisture-absorbing felts and a belt. The felts are trained around a cylindrical press roll with the web between them while the belt is arranged for applying pressure to the felts and roll. A pressure shoe exerts pressure on the belt in the press area.

A problem which has been encountered during the dewatering of webs in extended nips is that a bulge develops in the belt ahead of the nip. This problem is recognised in U.S. Patents Nos. 4,229,253 and 4,229,254, and certain belt constructions are suggested in these for overcoming the problem.

The aim of the present invention is to provide a press for dewatering a fibrous web, the press having an extended nip, but being arranged to overcome the above-mentioned problem in a particularly simple manner.

To this end, according to this invention, a press for dewatering a fibrous web comprises a press roll having a cylindrical exterior surface, a flexible belt comprising a base fabric partially empregnated with a polymeric material, a first side of the belt having a uniform smooth impervious impregnated surface, an extended nip provided between the press roll and the belt, papermakers felt means extending through the nip, a pressure shoe having an exterior surface engaging the first side of the belt and applying pressure to the felt means and, in use, to a fibrous web in the nip, and a second side of the belt containing voids into which liquid is transferred from the felt means which is in contact with the belt during the passage of the web and felt means through the nip.

A significant advantage of the construction of the felt in the press is that it can be made in any length since it does not require a mandrel during the manufacture thereof. A base fabric may be made endless using conventional fabric technology and then be partially impregnated with the polymeric material.

The resulting structure is both light in weight and sufficiently stable to operate under papermaking machine conditions. It has sufficient abrasion resistance to resist any wear that might take place in the extended nip. Unlike materials which are built up in the manner of a rubber tyre and can flow and/or delaminate, the belt will maintain its integrity. The construction of the belt also solves the problem of bulging near the press nip.

The invention also consists, according to another of its aspects, in a method, as later defined, for making the belt for the press.

Two examples of presses in accordance with the invention, and also an example of a method in accordance with the invention of making a belt for use in the press, will now be described with reference to the accompanying drawings in which:—

Figure 1 is a diagrammatic side view of the press;

Figure 2 is a partially sectional front view of the nip of the press shown in Figure 1;

Figure 3 is a sectional side view to a larger scale of part of a belt incorporated in the press; and,

Figure 4 is a sectional side view similar to Figure 3 but of another embodiment of the belt.

A press with an extended nip is provided for dewatering a travelling web of material. The nip 10 is formed between a cylindrical press roll 12, a pressure shoe 14 having an arcuate surface facing the press roll, and a belt 16 arranged such that it bears against the surface of the press roll. The arcuate surface of the pressure shoe has about the same radius of curvature as the press roll. The distance between the press roll and the pressure shoe may be adjusted by means of conventional hydraulic or mechanical apparatus (not show) connected to a rod 18 pivotally secured to the shoe 14. The rod may also be actuated to apply the desired pressure to the shoe. It will be appreciated that the pressure shoe and press roll described above and shown in Figures 1 and 2 are conventional and are only examples of arrangements that may be used.

One embodiment of the belt 16 is shown in detail in Figure 3. The belt 16 comprises a two layer woven monofilament base fabric 20, which has multifilament or spun stuffer yarns 21 and is impregnated on one face with a polymeric material 22. Thermosetting resins such as polyurethanes have been found to be suitable

impregnating materials. Thermoplastic polymers such as polypropylene are also acceptable. The base fabric 20 is sufficiently open to allow impregnation to eliminate the possibility of undesirable voids forming in the final fabric on the pressure shoe face which is the impregnated face. These voids are undesirable because they would allow the lubrication used between the belt and shoe to pass through the belt and contaminate the felt and fibrous web. The stuffer yarns 21 provide a barrier of sufficiently low permeability to prevent passage of the resin during the coating and impregnating process to the face with voids. The belt is endless in final construction and uniform in thickness. The fabric must also be made to have sufficient stability under papermaking machine conditions. In other words, it must have length stability, width stability, and guidability.

The thermoplastic resin or thermosetting resin used should be substantially entirely solid composition to avoid the formation of bubbles during the curing process of the resin in the belt structure which could cause voids on the coated side.

The face 17 of the belt can be ground smooth for contact with the pressure shoe 14. The opposite face or side contains voids, as a result of the weave and absence of impregnation, into which liquid can be transferred during the passage of the web, felt and belt through the nip.

A further example of the belt is shown in Figure 4. The components are similar to those in Figure 3. The components of Figure 4 have the same reference numerals as those of Figure 3 with a prime following. Belt 16' of Figure 4 is a multi layer structure with a barrier layer provided by stuffer yarns 21'. These stuffer yarns 21', can be multifilament or spun. The belt is coated and impregnated as described previously to provide a smooth impervious surface 17' and a surface with voids 18' on the remaining side. The use of belt 16 is the same as previously described for belt 16.

Another embodiment of the belt uses a different method of introducing the polymeric material into the belt structure. In this second method, polymeric material is pressed into the surface. The depth of penetration is controlled by the pressing force used and the temperature applied. Either thermoset or thermoplastic polymers can be used. Thermoplastic polymers are especially advantageous for this method since their viscosity in melted form can be controlled by temperature. By controlling the viscosity the depth of penetration can be controlled and the necessity of a barrier in the fabric structure is eliminated for polymer of the right viscosity.

In this method the belt 16 is positioned around a pair of rollers. One of the rollers is an oil heated cylinder. Polymeric material in sheet form, of the proper caliper, is placed between the belt and the heated cylinder and allowed to rotate around the cylinder. The cylinder temperature is maintained at the level desired to melt the polymeric material to the proper viscosity. It is then forced into the belt by the tension of the belt around the cylinder and roller. An outside pressure roll can be used to create additional pressure if needed. The sheet of polymeric material is trimmed so no overlap occurs in the material pressed into the belt.

Belts manufactured in accordance with the invention have been found to have many desirable characteristics. They move easily over the pressure shoe and are capable of transmitting pressure from the shoe to the web and press roll. Sufficient flexibility is obtained, and the belts have proven to be unaffected by lubricant applied prior to entering the press nip.

In comparison with belts currently known to the art, the belt in accordance with the invention is relatively thin and light in weight. Thick belts have the disadvantage of tending to flow while within the nip. A 24'6"x170" (7.5mx4.3m) belt impregnated with a thermosetting resin in accordance with the invention weighs about two hundred pounds (91 kg). A similar size belt having bulge-resistant characteristics and having a structure defined in the above-mentioned patents weighs about twelve hundred pounds (545 kg). Unlike the heavier belts, the belt in accordance with the invention does not require a reinforcing structure.

The manufacture of the belt may be accomplished economically and without the need for mandrels or autoclaves which limit the size of other belts. A belt of any length can accordingly be produced. A web may be needled into the woven base if desired. If the base structure has not been woven endless it is joined to make it endless using conventional joining techniques applicable to forming fabrics in the paper industry.

A belt made as described is utilised with the press shown in Figure 1. The belt 16 is positioned between the pressure shoe 14 and the pressure roller 12. The smooth impregnated side 17 of the belt is engaged by the shoe. A fibrous web 24 carried between first and second felts 26 and 27 respectively is introduced into the press nip 10. The side of the belt 17 engaging the shoe 14 is lubricated by lubricating means 28 positioned ahead of the nip.

The belt 16 is easily repaired should a hole or other surface irregularity develop therein. The damaged portion is cleaned with a solvent and a suitable amount of coating is applied with a blade. A heat gun is employed to cure the surface which can then be sanded.

Because of the excellent flexibility characteristics of the base structure and the fact that the coating layers can be kept to a minimum, the surface of the belt will have less tendency to fail due to bending fatigue. This is due to the fact that, because of the low caliper, the surface plane of the coated surface is at a minimum distance from the neutral axis of bending. This reduces the percentage of elongation and compression at the surface plane during bending.

It will be appreciated that the belt utilised in the invention may include a base fabric made

from various polymeric materials having the necessary properties for application in papermaking machines. Materials other than polyurethane and polypropylene may also be employed as the impregnating material. Also the weave of the belt may be altered although a multilayered belt is desirable for creation of the voids.

Claims

1. A press for dewatering a fibrous web comprising a press roll having a cylindrical exterior surface, a flexible belt comprising a base fabric partially impregnated with a polymeric material, a first side of the belt having a uniform smooth impervious impregnated surface, an extended nip provided between the press roll and the belt, papermakers felt means extending through the nip, a pressure shoe having an exterior surface engaging the first side of the belt and applying pressure to the felt means and, in use, to a fibrous web in the nip, and a second side of the belt containing voids into which liquid is transferred from the felt means which is in contact with the belt during the passage of the web and felt means through the nip.

2. A press according to claim 1, wherein the polymeric material is substantially entirely solid composition.

3. A press according to claim 1 or claim 2, wherein the base fabric is a multilayer fabric with a non-face layer of stuffer barrier yarns.

4. A press according to any one of the preceding claims, in which the polymeric material is a solid polyurethane resin composition.

5. A press according to any one of the preceding claims, in which the base fabric is woven.

6. A press according to claim 3, wherein the base fabric is of monofilaments with the exception of the stuffer yarns which are multifilament or spun.

7. A press according to claim 1, substantially as described with reference to Figures 1 and 2 and Figure 3 or Figure 4 of the accompanying drawings.

8. A method of manufacturing an endless belt for use in a press in accordance with claim 1, the method including providing an endless base fabric, coating and impregnating said base fabric by doctoring into the fabric a polymeric material from one face, curing said resin to form a smooth surface and providing means to limit the flow of impregnant through the base fabric to create voids on the other face of the base fabric.

9. A method according to claim 8, in which the means to limit the flow of impregnant includes stuffer yarns providing a barrier to flow of the polymeric material therethrough.

10. A method of manufacturing an endless belt for use in a press in accordance with claim 1, the method including providing an endless base fabric, mounting said base fabric about a heated cylinder and a second roller, introducing a polymeric sheet between said base fabric and said cylinder, said polymeric material having a lower melt point than said base fabric, applying tension on said belt by mean of the second roller, heating said cylinder such that the polymeric material melts and is forced into the base fabric by the pressure generated due to the tension on the base fabric, said polymeric material forming a smooth surface on the side of the base fabric facing the cylinder, and controlling the depth of penetration of the polymeric material into the base fabric by controlling the heat and pressure used in order to provide voids on the second side of the fabric.

11. A method according to claim 8, in which the structure of the base fabric is selected to provide voids in the face of the fabric away from the face receiving the polymeric material.

12. A method according to claim 10, including a third roller outside the fabric loop to apply pressure on the base fabric and polymeric sheet while they are on the cylinder.

13 A method according to claim 10, including the step of trimming the edges of said fabric after impregnating it with said polymeric material.

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